

REMARKS

This response is submitted to the Office Action mailed April 4, 2005, in the above-identified patent application.

Reconsideration is respectfully requested for claims 1-14 in the application in view of the following remarks.

Claims 1, 5, 8, 11 and 14 have been rejected under 35 USC §102(b) as being anticipated by Streit et al. 5,631,477, the Examiner referring to the HBT shown in Fig. 2 and the collector region (layers 18a, 20a, 22a). The Examiner alleges that the collector region has decreasing dopant concentrations toward the base region with the layer in the collector region (22a) abutting the base region (40) having the lowest dopant concentration ($9 \times 10^{15}/\text{cm}^3$), the collector region having a non-uniform doping with the lightest doping ($9 \times 10^{14}/\text{cm}^3$) near the base region (40) and heaviest doping ($1 \times 10^{19}/\text{cm}^3$) near the subcollector region (14a) the highest doping being less than the doping ($2 \times 10^{19}/\text{cm}^3$) in the subcollector region.

This rejection is respectfully traversed. As defined by claim 1 in the application, the claimed heterojunction bipolar transistor (HBT) includes "c) a collector region of the one conductivity type abutting the base region, the collector region comprising at least three layers having decreasing dopant concentrations toward the base region, the layer in the collector region abutting the base region having the lowest dopant concentration."

Streit et al. does not disclose this. Further, Streit et al. are similar to the previously cited Burton et al., U.S. Patent No. 6,531,721 in providing a three layer collector region with the lightest doping being in the middle layer, and not in the layer abutting the base.

As the Examiner correctly notes, Streit et al. disclose in Fig. 2 a collector region including layers 18a, 20a, 22a with layer 22a abutting base layer 40. And as the Examiner correctly notes, layer 22a abutting base 40 has a doping concentration of $9 \times 10^{15}/\text{cm}^3$. However, the Examiner fails to note that the middle layer 20a has a doping concentration of $1 \times 10^{15}/\text{cm}^3$, which is lower than the $9 \times 10^{15}/\text{cm}^3$ of layer 22a. See column 4, lines 6-12.

Accordingly, while Streit et al. do disclose a three layer collector region, the lightest doping in the collector region is in the middle layer 20a, and not in the layer 22a abutting the base region, as claimed.

The Streit et al. structure and teaching is similar to the Burton et al. which is described in detail in the previous amendment and remarks. In particular, it is noted that while placing a medium/high doped collector layer abutting the base can help reduce the base push out effect, as taught by Burton et al., it can also present another problem: at lower V_{ce} the electric field in the low doped collector layer in the middle of the collector could reverse direction and trap electrons. This will degrade the transistor performances in RF operation.

Accordingly, it respectfully submitted that claims 1, 5, 8, 11 and 14 are patentable under 35 USC §102(b) or 103 over Streit et al.

Claims 2 and 9 have been rejected under 35 USC §103(a) as being unpatentable over Streit et al. in view of Luryi 5,496,743. The Examiner referring to Luryi disclosing a composite in which the layer abutting the base is thicker than the other layers.

This rejection is respectfully traversed for the reasons given above for claims 1 and 8 from which claims 2 and 9 depend. Streit et al. do not disclose a composite collector region in which the lightest doping is in the layer abutting the base. Rather, Streit et al. disclose the lightest doping being in the middle layer of the collector structure.

Claims 3, 4, 6, 7, 10, 12 and 13 have been rejected under 35 USC §103(a) as being unpatentable over Streit et al. in view of Luryi, the Examiner alleging that the recited doping concentrations are subject to routine experimentation and optimization.

This rejection is respectfully traversed for the reasons given above. Specifically, Streit et al. do not disclose the collector region comprising at least 3 layers having decreasing dopant concentrations toward the base region with the layer in the collector region abutting the base region having the lowest dopant concentration. As noted above, in the Streit et al. transistor structure, the lowest doping concentration is in the middle layer 20a, and not in the layer 22a abutting the base region.

For the foregoing reasons, it is respectfully submitted that claims 3, 4, 6, 7, 10, 12 and 13 along with dependent claims 2 and 9 are not shown or suggested by Streit et al in view of Luryi.

Since claims 1-14 are patentable under 35 USC §102(b) or §103(a) over Streit et al., alone or taken with Luryi, all as above set forth, it is requested that claims 1-14 be allowed and the case advance to issue.

Should the Examiner have any questions or comments concerning the present response, a telephone call to the undersigned attorney (650-314-5311) is requested.

Respectfully submitted,
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